A 5,730-Hr Cyclic Endurance Test Of The SPT-100

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ABSTRACT

A cyclic endurance test of the Russian 1.35 kW Stationary Plasma Thruster SPT-1OO is described. The endurance test was performed for 6,925 on/off cycles and 5,730.3 hours of operation at an input power to the thruster of 1.35 kW. Each cycle was approximately 50 minutes of thruster on-time and 23 minutes of thruster off-time. Thruster efficiency decreased from 50% to 42% as the thruster aged over the first 1,000 hours. The efficiency increased s1ow1 y over the next 1,000 hours and then slowly decreased to 4S % by the end of the wear test. The unused cathode igniter and radiation shields were found to erode at an unexpectedly high rate. A short between the cathode emitter and cathode igniter occurred at cycle 5,316; the short was cleared without opening the vacuum tank but the short reoccurred at cycle 6,344. The vacuum chamber was opened after the thruster had accumulated 6,346 cycles and 5,250 hours of operating time to clear this short and repair the thrust stand, which had failed at cycle 5,818. The wear test was continued and voluntarily terminated when 5,002.5 hours of operation were accumulated on cathode #l. Data from this wear test indicate that the likely first failure mechanism for this thruster design is shorting between the igniter and cathode emitter in the unused cathode. The endurance test was performed under a cooperative program between Space Systems/Loral, JPL, and the Ballistic Missile Defense Organization (BMDO).